

Design and Analysis of Metal-to-Composite Nozzle Extension Joints, Phase I

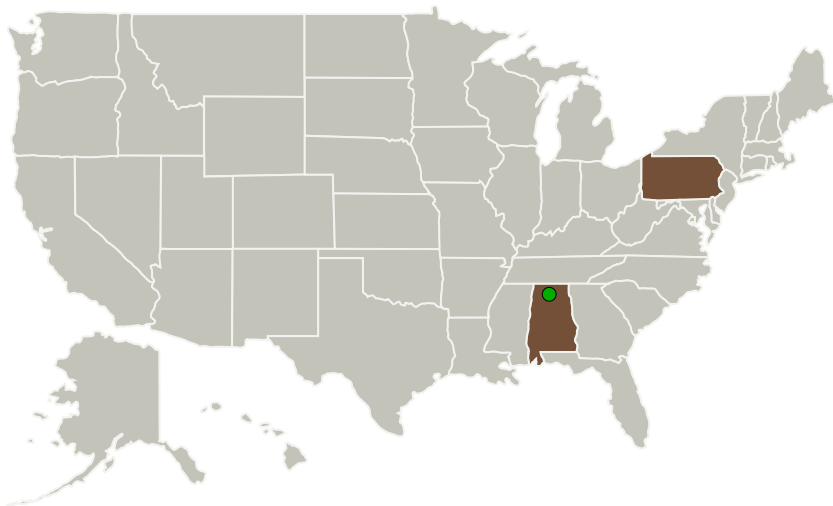
Completed Technology Project (2011 - 2011)



Project Introduction

As the operational demands of liquid rocket engines increases, so too does the need for improved design and manufacturing methods for metal-to-composite nozzle extensions. The state of the art utilizes non-domestic composite materials for nozzle extensions. Although this solution does offer weight savings and increased performance, there is an increase in cost and the addition of Export regulations. Within this effort, Materials Research & Design (MR&D) is proposing an analytical study, coupled with subcomponent fabrication and testing, that would result in a design for a domestically available C-C nozzle extension and metallic-to-composite joint for the J-2X. The proposed study would investigate various mechanical attachment methods, such as mechanical fasteners and adhesives for both the CMC-to-metallic joint and the CMC-to-CMC joint. Additional aspects of the trade study would investigate various flange shapes and materials in order to reduce the critical stresses in the region.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Materials Research and Design, Inc.	Lead Organization	Industry	Wayne, Pennsylvania
● Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Pennsylvania

Project Transitions

▶ **February 2011:** Project Start

✓ **September 2011:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138079>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Materials Research and Design, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

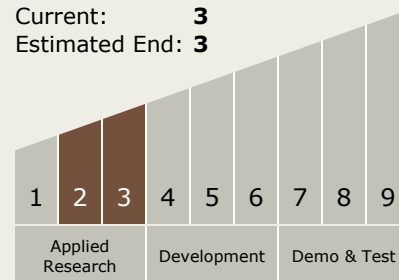
Carlos Torrez

Principal Investigator:

Craig Iwano

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



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Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.3 Cryogenic

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System